Name:	
Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2019

Programme Name: B. Tech ASE and ASE+AVE — Semester : VIII
Course Name : Space Science and Space Environment — Time : 03 hrs
Course Code : ASEG 485 — Max. Marks: 100
Nos. of page(s) : 3

SECTION A

S. No.		Marks	Cos
Q 1	Please mark as True or False for the following statements **a.** The particles are mainly protons and neutrons, which are trapped within the belts by the earth's magnetic field. (T/F) **b.** A geomagnetic storm is a permanent disturbance of the Earth's magnetosphere (T/F) **c.** Sun rotates around the galactic center with a period of 225 million years (T/F) **d.** Europa is the sixth largest moon in our solar system (T/F) **e.** The smaller the apparent magnitude, the brighter a star appears (T/F)	5	CO1
Q.2	Knowing that the apparent visual magnitude of the Sun is − 26.73, calculate its absolute magnitude.	5	CO2
Q.3	A star has an apparent magnitude of 6.0 and 9.0 as minimum and maximum respectively. Its minimum and maximum effective temperature is 2600*K* and 1900*K*. Find the ratio of maximum and minimum radii?.	5	CO2
Q.4	Consider a circular bathtub initially filled with water draining out with a speed of 5 m/s through a hole at the bottom center of the bathtub. The Coriolis force is given by $F_{co} = 2\Omega \sin(\Phi)\, v$ (m/s^2) where $\Omega = 7.27\text{x}\ 10^{-5} s^{-1}$is the earth's rate of rotation, $\Phi = 22^0$ denotes the latitude and v is the speed relative to the Earth. (i) Compute the magnitude of the Coriolis force deflecting the draining water. (ii) Is the Coriolis force acting on the water either greater than, less than or equal to the force of gravity (g=9.8 m/s^2) acting on the water?	5	CO2

SECTION B

Q.5	Antares is a giant star with an apparent magnitude of -1.2, parallax of 0.0095 and a surface temperature of 3100 K. Its mass is 30 times the mass of the sun. Compare the average density of Antares to that of the sun.	10	CO2
Q.6	(i) Describe the effects of a magnetic field on a moving charge. (ii) Viewers of Star Trek have heard of an antimatter drive on the Starship Enterprise. One possibility for such a futuristic energy source is to store antimatter charged particles in a vacuum chamber, circulating in a magnetic field, and then extract them as needed. Antimatter annihilates normal matter, producing	5 5	CO3

	pure energy. (a) What strength magnetic field is needed to hold antiprotons, moving at 5.0×10^{7} m/s in a circular path 2.00 m in radius? Antiprotons have the same mass as protons but the opposite (negative) charge. (b) Is this field strength obtainable with today's technology or is it a futuristic possibility?		
Q.7	If a photon travels 0.01m at each interaction jump in the sun and if the radius of the sun is 7×10^{10} cm and if the number of jumps for a photon to travel to surface is given by the relation of a ratio of square of the radius by square of the distance of photon jump; then calculate the number of jumps required for the photon to reach the surface of the sun and calculate the amount of time it takes for this process to occur.	10	CO2
Q.8	Write the 10 major effects of space weather on Earth.	10	CO4
SECTION-C **Q.10 is compulsory. Attempt any one out of Q.11 and Q.12**			
Q.10	Write the short notes on the following: (i) Nebula and types of Nebula (ii) Black Holes and their properties (iii) Big Bang expansion (iv) Milky Way Galaxy and Orion arm	20	CO1
Q.11	(i) What is space radiation? What are the effects of space radiation?	10	CO4
	(ii) Suppose the radial distance, R(T) between the center of Earth and space craft as a function of time, T elapsed in hours can be modeled as a simple linear function during the time the shielded spacecraft is inside the Van Allen belts and the radiation dose rate, D(R) is modeled by a simple power-law function: $$R(T) = 7000 + 3000\,T \;\; (Km)$$ $D(R) = 60\left(\frac{R}{25000}\right)^{2}$ (mGrays/hour) where R is in Km) (a) Find out the accumulated radiation dose for one 10-hour orbit of the space craft. (b) How many years will it take for the spacecraft total dose to equal 1000 Grays?	10	
Q.12	(i) Define the different units for the measurement of ionizing radiations. What is the difference between Sievert and Gray?	5	CO4
	(ii) Spacecraft engineers design space craft by considering the radiation environment to shield the astronauts from harmful ionizing space radiations. For designing purpose, they used the following model for the orbit path as a function of angular position, R(θ) and radiation dose rates, G(R).		

	$\frac{R(\theta)}{R_0} = 5.7 - \left[\frac{210}{100 - 55\cos\theta}\right]$ where R_0 is the earth radius equal to the 6378 Km $T(\theta) = \frac{9}{2\pi}\,(\theta - 0.55\,\sin\theta)$ hours G(R)= 0.136 R6 – 2.194 R5 + 13.89 R4 – 43/73 R3 + 71.78 R2 – 57.95 R + 18.15 Grays/hours.		
	(a) Construct the function table where the columns are θ, T(θ) in hrs, R(θ) in multiple of Ro and G(θ) in Grays/hrs.	5	
	(b) Plot the graph G(T) in (Grays/hrs) Vs Time (in hrs) over one complete orbit over the domain T [0, 9hrs].	5	
	(c) Estimate the geometric area under the curve and then calculate the total accumulated dose over the one complete orbit.	2	
	(d) If 1 cm thickness of aluminum reduce the radiation by 15 times, then how many cm of shielding will be needed to reduce the total accumulated dose to 1000 Grays over 5 years.?	3	